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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/072,362

02/07/2002

Kuan-Yu Fu

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2716

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7590

11/25/2005

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EXAMINER

HU, SHOUXiang

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/072,362

Applicant(s)

FU, KUAN-YU

Examiner

Shouxian Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 January 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 09/059,548.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claims 10-15 are objected to because of the following informalities and/or defects:

In claims 10 and 13, the terms of "first and second trench" should read as: --first and second trenches--.

In claims 10-15, the term of "thick insulating layer" should read as: --thin insulating layer--, according the original specification (see lines 19-21 on page 5).

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10-15, as being best understood in view of the claim objections above, are rejected as being unpatentable over Lancaster (US 4,835,584) in view of Lee (US 4,685,196) and/or Solomon (US 5,108,938).

Lancaster discloses a semiconductor structure (Figs. 1-7F, especially Figs. 4, 5L, and/or 7F), comprising a substrate having an active region including a channel region

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(under each bottom of the gate oxide layer 57 in Fig. 5L or 72 in Fig. 7F) and a non-channel region surrounding the channel region; a first trench and a second trench disposed near the channel region, an insulating layer (57 in Fig. 5L or 72 in Fig. 7F; a silicon oxide gate insulating layer, about 0.1 μm , see col. 3, line 61; it can be regarded as a relatively thin or thick insulating layer, depending on what thickness it is compared to) over the first and second trenches and conformal to the profile of the first and second trenches; a gate electrode (58 in Fig. 5L or 75 in Fig. 7F) disposed over the two trenches and comprising a first vertical portion, a second vertical portion and a horizontal portion, with the first vertical portion being embedded inside and substantially fills the first trench, the second vertical portion being embedded inside and substantially fills the second trench, and the horizontal portion being disposed over the substrate and connecting the first and second vertical portions together; a first shallow doped region (the top horizontal portion of region 73 or 77) within the substrate at an upper corner adjacent to the first vertical portion of the gate electrode and a second shallow doped region (the upper horizontal portion of region 74 or 78) at an upper corner adjacent to the second vertical portion of the gate electrode; a deep source region (the lower portion of region 73 or 77) and a deep drain region (the lower portion of region 74 or 78) disposed in a region in the substrate at a depth deeper than the first and second trenches.

The insulating layer and the gate electrode in Lancaster can completely fill the trenches along the channel width direction (see Figs. 6 and 7).

Although Lancaster does not expressly disclose that the insulating layer and the gate electrode can also completely fill the trenches along the channel length direction (i.e., the source-to-drain direction, which is perpendicular to the channel width direction), one of ordinary skilled in the art would readily recognize that such complete filling would be desirable either for enhancing the gate conductance by maximumly expanding the gate size along the source-to drain direction while still being insulated from the source and drain regions with the insulating layer, or for minimizing the device size along the source and drain direction by eliminating as many non-active spaces as possible along the source-to-drain direction, as evidenced in Lee (see the gate 24 and the insulating layer 22 in the cover page figure) or in Solomon (see the gate 57 and the insulating layer 61 in the cover page figure).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the device of Lancaster with the gate and the insulating film completely filling the trenches along the source-to-drain direction, per the teachings of Lee and/or Solomon, so that a semiconductor structure with enhanced gate conductance and/or reduced device size would be obtained.

Regarding claims 11 and 14, it is noted that it is art known that the insulating layer used as a gate oxide layer can be readily formed through thermal oxidation for achieving high quality in the gate insulating layer, as further evidenced in Lee (see col. 3, lines 61-66).

Response to Arguments

Applicant's arguments with respect to claims 10-15 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH
November 20, 2005



SHOUXIANG H.
PRIMARY EXAMINER